6.1 Development of the Modern Periodic Table

A. First lists of elements appeared in the 1700s: by the late 1800s there were 60 known elements
   1. Major break through occured when scientists agreed on a method for determining atomic masses in 1860

B. John Newlands (1837-1898)
   1. In 1864, Newlands proposed an organizational scheme for elements (Figure 1, p. 335)
      a. based chart on "law of octaves", stating elements properties repeated every eighth element by atomic mass

C. Dimitri Mendeleev (1834-1907) + Lothar Meyer (1830-1895)
   1. concluded that when elements were ordered by atomic mass, there was a periodic pattern to their properties
      a. Mendeleev's Table (Figure 2, p. 336)

D. Henry Mosely (1887-1913)
   1. First to arrange elements in order of increasing atomic #

* E. Periodic Law- confirms their is a repetition in chemical + physical properties of elements if they are arranged by increasing atomic #
   → See Table 2 (p. 338)

II The Modern Periodic Table

A. Consists of boxes containing an element symbol, atomic #, and atomic mass
   1. Columns = groups/families, Rows = periods

B. Elements in group 1-2 and 13-18 have a wide range of physical/chemical properties = representative elements

C. Groups 3-12 = transition elements
   1. Elements are classified as metals, nonmetals, and metalloids

November 19, 2014

D. Metals - shiny, solid @ room temp, good conductor
1. Alkali Metals - (except H) group 1 elements
a. highly reactive, usually exist as a compound
2. Alkaline Earth Metals - group 2, also highly reactive
→ Figure 6, p. 339 show several uses of alkaline earth metals

E. Transition metals + inner transition metals
1. = lactanide + actinide series
a. Lathanide elements - used extensively as phosphors; emit light when struck by electrons

F. Non-metals - occupy upper-right side of periodic table
1. Elements that are generally gases or brittle, dull solids
2. Group 17 = Halogens: highly reactive: F in toothpaste
3. Group 18 = Noble gases - extremely unreactive
ex Neon → signs
4. Metalloids (or semimetals) - border stairstep line → Figure 5 (p. 339)
1. have physical + chemical properties of both metals + nonmetals

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* Which element is more reactive sodium (Na) or gold (Au)?
* Chlorine or Copper?
* How do you know?

6.1 Review

Grade: 11th

Subject: chemistry

Date:

1 List an element that has similar chemical properties to iodine (I).

F

2 List an element that has similar chemical properties to iron (Fe).

Os

3 Lithium (Li) is a transition element.

True

False

4 Carbon is a representative element.

True
False

5 Newlands proposed an organizational scheme for elements based on increasing atomic mass and that their properties repeated every eighth element. He called this periodic relationship...

A periodic law
B rule of elements
C law of octaves

6 Alkali metals are the first group on the periodic table.

Yes
No

7 _____ are elements on the periodic table that have physical and chemical properties of both metals and nonmetals.

metalloids

6.2 Classification of the Elements

I. Organizing Elements by their electron configuration

A. Electron configuration determines the chemical properties of an element

B. The highest principal energy of an atom are the valence electrons

1. Group 1 = 1 valence electron
→ s^1 for all of group 1

and it continues with this trend for group 2 and groups 13-18

II. s-, p-, d-, f block elements

A. Because there are four different energy sublevels, there are only four distinct blocks (s, p, d, f)

B. S block (s^1-s^2)

1. all alkali metals + alkaline earth metals

C. P block

1. comprised of groups 13-18
2. group 18 (noble gases) are unique because their atoms are so stable that they undergo virtually no chemical rxns (reactions)

D. d-block

1. contains transition metals and are largest of the blocks (most elements)
2. Five orbitals hold ten electrons → therefore ten groups

E. F-block

1. contains seven f orbitals = 14 groups on periodic table
2. contains the inner transition metals
f sublevel does not fill orbitals in a predictable manner

F. s, p, d, f blocks determine the shape and organization of the periodic table

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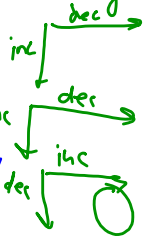
What are the trends on the periodic table or the periodic trends for the following:

1) Atomic radii
2) Ionic radii
3) Ionization energy
4) Electronegativity



Periodic Table (part deux)

Grade: 11th

Subject: Chemistry

Date:

1 Which of the following are poor conductors of heat and electricity?

A metalloids
B metals
C nonmetals
D alkaline earth metals

2 Which group on the periodic table is known as the alkaline earth metals?

A 1A
B 2A
C 8A
D 7A

3 Halogens are good disinfectants. Which of the following is a Halogen?

A N
B O
C Fe
D Cl

4 What makes the d block wider than either of the s block or p block?

A the d suborbital can hold ten electrons, making the d block ten elements wide
B the d block is the most researched block on the periodic table
C the elements in the d block are all metals

5 The ___ block contains the most elements on the periodic table.

.

6 Elements within a period have similar chemical properties.

True

False

.

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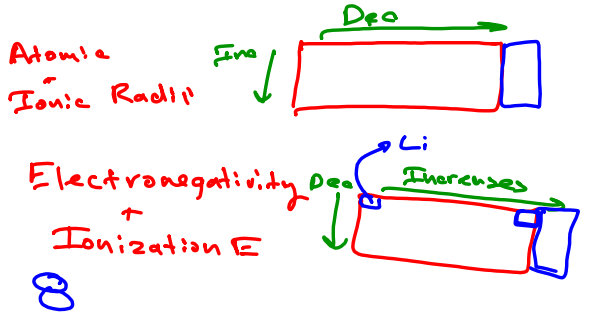
→ Without using the periodic table determine the group, period, and block of the following elements:

1) [Ne] $3s^2$ $3p^6$

2) [He] $2s^2$

3) [Kr] $5s^2$ $4d^{10}$ $5p^6$



8

6.3 Periodic Trends

I. Atomic Radius

A. Many properties of the elements tend to change in a predictable way; called trends

1. periodic trend = increase in atomic # (size)

a. sizes of atoms are influenced by their electron configuration

B. Electron Cloud is not clearly defined

1. Atomic size is determined by how close an atom is to a neighboring atom

C. For metals, atomic radius = $\frac{1}{2}$ distance between adjacent nuclei of atoms in a crystal of an element

D. For elements commonly occur as compounds (like nonmetals) atomic radius = $\frac{1}{2}$ distance between identical atoms that are chemically bonded together

E. Trends within periods → decrease in atomic radii from left to right
1. Each successive element has one more proton + elec.

F. Trends with groups → increase as you move down the group

✡ → see Figure 17, p. 360

II. Ionic Radius - atoms gain or lose electrons to form ions

A. Ion - atom or bonded group of atoms that has a + or - charge

1. ionic radius increases as atoms for neg. ions, and dec. as they form positive (+) ions
→ see Figure 20, p. 363

III Ionization Energy

A. Generally increase from left to right across a period, and decrease as you move down a group

B. Ionization Energy - the energy required to remove an electron from a gaseous atom

1. low ionization energies show that an atom loses an outer e⁻ easily

C. Octet Rule - atoms tend to lose, gain, or share e⁻ in order to acquire a full set of eight valence electrons

IV Electronegativity - indicates the relative ability of its atoms to attract electrons in a chemical bond

A. Electroneg. generally increases across the period from left → right, and decreases down a group

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1) Is it matter?
   1) Microwaves — No
   2) Heat from sun — Y
   3) Velocity — N
   4) Air — Yes
   5) Helium in a balloon — Y
   6) A speck of dust — Y

2) What is an ion? a charged atom of an element

3) Which element is more electronegative?
   1) K, As
   2) N, Sb
   3) Sr, Be

Table of Elements Review

Grade: 11th

Subject: Chemistry

Date:

1 The _____ states that atoms gain, lose, or share electrons to acquire a full set of valence electrons.

octet rule

2 Why is helium included with the noble gases, even though it only has two valence electrons?

A the p sub-orbital does not exist for period 1
B Helium was discovered first
C Helium's missing electrons cause it to be lighter than air
D Helium's electron configuration is incorrect

3 Atoms that lose electrons to become positive ions are _____.

A nonmetals
B metalloids
C metals
D noble gases

4 Which element has the lowest first ionization ~~first~~ energy?

A Li
B Na
C K
D Cs

5 The ionic compound, sodium chloride, is formed from atoms of the elements sodium and chlorine. What happens to the size of each atom when it forms an ion?

A sodium increases in size and chlorine increase in size
B sodium increases in size and chlorine decreases in size
C sodium decreases in size and chlorine increases in size
D sodium decreases in size and chlorine decreases in size

6 Which of the following elements is most likely to form a negatively-charged ion?

A I
B Br
C Cl
D F

7 Atoms with large ionization energy values are _____.

A more likely to form positive ions
B less likely to form positive ions
C most likely to lose their outer electrons
D lacking valence electrons

Periodic Table Review

Grade: 11th
Subject: Chemistry
Date:

1 Mendeleev's periodic table was in error because he used atomic mass instead of atomic number to order elements.

True
False

2 Newlands came up with the law of octaves. Essentially, this was important to the development of the modern periodic table because it introduced the idea of periodically repeating patterns in elements.

True
False

3 Periodic Law (2 words) states that when the elements are arranged by increasing atomic number, there is a periodic repetition of their chemical and physical properties.

4 Metalloids have properties intermediate between metals and nonmetals.

5 Oxygen is a...

A metal
B nonmetal
C metalloid

6 Barium is a...

A metal
B nonmetal
C metalloid

7 Germanium is a ....

A metal
B nonmetal
C metalloid

8 Iron is a ...

A metal
B nonmetal
C metalloid

9 There Their are more elements classified as nonmetals and metalloids compared to metals.

True
False

10 _____ metals are in group 1.

Alkali

11 Noble gases are in group 17.

True

False

12 Group two contains the ...

A transition metals
B alkaline earth metals
C halogens

13 Write the chemical symbol for the element that is a radioactive gas used to predict earthquakes. Also, this element is the noble gas with the greatest atomic mass.

Rn

14 All the noble gases (except Helium) have ____ valence electrons.

8

15 The four blocks of the periodic table are represented by the following four letters: _, _, _, and _.

s, p, d, f

16 Given any two elements within a group, the element with the larger atomic number will have a larger atomic radius than the other element.

True
False

17 Ion E
~~Electronegativit~~y is the energy needed to remove an electron from a neutral atom in its gaseous state.

True
False

18 Which element has a larger ionization energy: Li or N?

19 Which element has a larger ionization energy: Kr or Ne?

Ne

20 Which element has a larger ionization energy: Cs or Li?

Li

21 Boron is the metalloid in period 2 of the periodic table that is part of compounds used as water softeners.

True
False

22 A(n) ion is an atom that has lost or gained one or more electrons.

23 Which element is more electronegative: K or As?

As

24 Which element is more electronegative: N or Sb?

25 Which element is more electronegative: Sr or Be?

Be